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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/809,663

03/15/2001

Mukesh V. Khare

FIS920000396US1 /
I30-000

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03/20/2003

INTERNATIONAL BUSINESS MACHINES CORPORATION
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BLDG. 300-482
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EXAMINER

TOLEDO, FERNANDO L

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 03/20/2003

15

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

Application No.

09/809,663

Applicant(s)

KHARE ET AL.

Examiner

Fernando Toledo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 December 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3 and 6-8 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 6-8 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1 – 3 and 6 – 8 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 1 recites the limitation a nitrogen concentration of at least 2.0×10^{15} atoms/cm². The units of concentration are atoms/cm³ and not atoms/cm², which are the units of dosage. It is not clear what Applicant meant to disclose if it was a concentration amount or a dosage amount, the inconsistency of units could be seen also throughout the specification.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

4. Claims 1 – 3 and 6 – 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation a nitrogen concentration of at least 2.0×10^{15} atoms/cm². The units given for the concentration are inconsistent for the accepted meaning of concentration, which is atoms/cm³.

Claim Objections

5. Claim 3 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 3 discloses wherein the final thickness is less than 20 Å. However, claim 1, discloses wherein the final thickness is less than 15 Å, which, is less than 20 Å.

Claim Rejections - 35 USC § 102

6. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

7. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Kraft et al. (U. S. patent 6,136,654).

In re claim 1, Kraft in the U. S. patent 6,136,654; figures 1 – 8 and related text discloses forming an initial oxynitride layer 14 upon a substrate material, the oxynitride layer having an initial physical thickness (column 3, lines 52 – 56); subjecting the initial oxynitride layer to plasma nitridation, the plasma nitridation resulting in final oxynitride layer, the final oxynitride layer having a final physical thickness (column 3, lines 59 – 67 and column 4, lines 1 – 11); wherein the final oxynitride layer has a nitrogen concentration of 0.1 to 57 atomic % (column 5, lines 24 – 28); wherein the final oxynitride layer has an equivalent oxide thickness of less than 15 Å and a nitrogen concentration of at least 2.0×10^{15} atoms/cm² (figure 7).

Claim Rejections - 35 USC § 103

8. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
9. Claims 2 – 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kraft as applied to claims 1 and 5 above.

In re claim 2, Kraft does not show wherein the final physical thickness exceeds the initial thickness by less than 5 Å.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the final physical thickness exceeds the initial thickness by less than 5 Å in the invention of Kraft, since insulation thicknesses are well-known process variables and finding the optimum or workable ranges of those thicknesses requires only ordinary skill in the art. Note that the specification contains no disclosure of either the critical nature of the claimed thicknesses or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen thicknesses or upon another variable recited in a claim, the Applicant must show that the chosen thicknesses are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claim 3, Kraft does not disclose wherein the final physical thickness is less than 20 Å.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the final physical thickness less than 20 Å in the invention of Kraft, since insulation thicknesses are well-known process variables and

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finding the optimum or workable ranges of those thicknesses requires only ordinary skill in the art. Note that the specification contains no disclosure of either the critical nature of the claimed thicknesses or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen thicknesses or upon another variable recited in a claim, the Applicant must show that the chosen thicknesses are critical. *In re Woodruf*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

10. Claims 6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kraft as applied to claims 1 and 5 above, and further in view of Ito et al. (U. S. patent 4,980,307).

In re claim 6, Kraft does not teach wherein the initial oxynitride layer is formed upon the substrate by ionically implanting nitrogen atoms into the substrate and oxidizing the substrate, following the substrate being ionically implanted with nitrogen atoms.

However, Ito in the U. S. patent 4,980,307 discloses forming an oxynitride layer wherein the substrate is nitrated (by plasma) followed by an oxidation treatment, which allows for an increased thickness of the initial oxynitride layer (columns 6 and 7).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the initial oxynitride of Kraft by the method of Ito since it allows for an increased thickness of the initial oxynitride layer.

In re claim 8, Kraft in view of Ito does not show wherein the final oxynitride layer further has a reduction effective electron mobility, μ_{eff} , of less than 20% from the effective electron mobility of the initial oxynitride layer.

However, since Kraft in view of Ito disclose the invention it would have been obvious to one having ordinary skill in the art at the time the invention was made to achieve the same reduction in effective electron mobility since the effective electron mobility is a direct result of the formation of the final oxynitride layer.

11. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kraft as applied to claims 1 and 5 above, and further in view of Gusev et al. ("Growth and characterization of ultrathin nitrided silicon oxide films" pp 1 – 22).

Kraft does not disclose wherein the initial oxynitride layer is formed upon the substrate by rapid thermal nitric oxide deposition.

However, Gusev in the article "Growth and Characterization of Ultrathin Nitrided Silicon Oxide Films, pp 1 – 22 discloses that by forming the oxynitride film with a rapid thermal nitric oxide deposition, the nitrogen is more effectively incorporated in the dielectric film than by using N₂ or N₂O (pages 8 and 9).

Therefore It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the initial oxynitride film of Kraft by the method of Gusev, because the nitrogen is more effectively incorporated in the dielectric film than by using N₂ or N₂O.

Terminal Disclaimer

11. The terminal disclaimer filed on December 30, 2002 disclaiming the terminal portion of any patent granted on this application, which would extend beyond the expiration date of US 6,444,592 B1 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Response to Arguments

12. Applicant's arguments with respect to claims 1 – 3 and 6 – 8 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

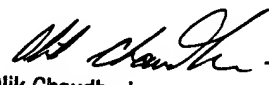
13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fernando Toledo whose telephone number is 703-305-0567. The examiner can normally be reached on Mon-Fri 8am to 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7382 for regular communications and 703-308-7382 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Fernando Toledo
Examiner
Art Unit 2823

ft
March 14, 2003


Olik Chaudhuri
Supervisory Patent Examiner
Technology Center 2800